

# Methods for securing endotracheal tubes in newborn infants (Protocol)

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# Methods for securing endotracheal tubes in newborn infants

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## ABSTRACT

This is the protocol for a review and there is no abstract. The objectives are as follows:

To determine the effect of different methods of securing endotracheal tubes on the risk of accidental extubation and complications of endotracheal intubation in neonates requiring mechanical ventilation.

Data permitting, subgroup analyses of the following are planned to determine whether results differ by:

1. Weight at time of randomisation (< 1000g versus ≥ 1000g)
2. Nasal versus oral intubation.

## BACKGROUND

### Description of the condition

Mechanical ventilation is commonly required in the management of critically ill newborn infants. For the vast majority of infants, mechanical ventilation is administered via an endotracheal tube. In order to provide effective ventilation as well as minimise accidental extubation and other complications, the tube must be adequately secured. Poor fixation of the endotracheal tube has been reported to be the most common cause of accidental extubation (Veldman 2006). Reintubation following unplanned extubation can expose the infant to additional pain and trauma. With each intubation

attempt there is the potential risk for local trauma to the mouth and pharynx from the laryngoscope (Ahluwalia 2005) and vocal cords and trachea from the endotracheal tube. Skin loss secondary to repeated removal of tape adhesive can lead to infection and further pain. Ideally, these complications can be avoided if the tube is well secured after the first successful intubation.

The optimal position for the lower end of the endotracheal tube in newborn infants is midway between the larynx and the carina. As this distance can be very short, there is minimal room for error. Apart from accidental extubation, poor fixation can lead to the tube being positioned too low resulting in bronchial intubation and subsequent lung collapse or air leak.

Many methods of endotracheal tube fixation have been em-

ployed with different levels of success and risk of complications. Some of these methods include adhesive tapes (Emami 1981), sutures (Cussel 1974), silk ties (Andrews 2007), endotracheal tube holders (Petros 1997), umbilical cord clamps (DeJonge 1998; Loughhead 2008), head restraints (Bloch 1973) and bonnets (Grammatikopoulos 2003) or a combination of these techniques (Cussel 1974). The ease and success of each method can be affected by the level of skill of the nursing and medical staff. Some infants only require a short period of ventilation, while others may need to remain intubated for many weeks. With the advent of plastic endotracheal tubes (Shann 2003), the capability for prolonged endotracheal intubation has contributed to a significant improvement in survival, especially in the preterm infant population. Reported complications of prolonged intubation include the development of pressure areas and cosmetic deformity, airway damage, subglottic stenosis, iatrogenic cleft palate (Ahluwalia 2005), palatal grooves (Macey-Dare 1999) and defective dentition (Angelos 1989).

### Description of the intervention

Methods of tube stabilisation include but are not limited to adhesive tapes, sutures, silk ties, endotracheal tube holders, umbilical cord clamp, head restraints and or a combination of these techniques.

### How the intervention might work

The ideal tube stabilisation method must be able to allow movement of the infant during care and minimise movement of the tube. It should also decrease the number of times the tube needs re-taping or adjustment as each episode of tube manipulation may increase the risk of tube dislodgement. The optimal method may also differ depending on whether the infant is nasally or orally intubated.

### Why it is important to do this review

There is wide variation in the methods of endotracheal tube fixation in neonates. It would be helpful to determine the most effective way to stabilise the endotracheal tube in this population.

## OBJECTIVES

To determine the effect of different methods of securing endotracheal tubes on the risk of accidental extubation and complications of endotracheal intubation in neonates requiring mechanical ventilation.

Data permitting, subgroup analyses of the following are planned to determine whether results differ by:

1. Weight at time of randomisation (< 1000g versus  $\geq$  1000g)
2. Nasal versus oral intubation.

## METHODS

### Criteria for considering studies for this review

#### Types of studies

Randomised controlled trials of any quality and some types of non-randomised trials (i.e., quasi-randomised trials) in intubated neonates.

#### Types of participants

Infants admitted to the neonatal intensive care unit who require intubation for mechanical ventilation.

#### Types of interventions

Studies which compare different methods of endotracheal tube fixation, which may include but not necessarily be limited to the use of adhesive tapes only, the use of sutures or ties alone or in combination with tapes, endotracheal tube holders, umbilical cord clamps, the use of head restraints, the use of bonnets that encompass the head or any other method not included in the above.

#### Types of outcome measures

##### Primary outcomes

1. Accidental extubation (number of episodes per patient-days of intubation)
2. The need for reintubation (number of episodes per patient-days of intubation)
3. Rate of tube malposition on x-ray (number of episodes per patient-days of intubation)

##### Secondary outcomes

1. Mortality (neonatal mortality and mortality during hospital admission)
2. Incidence of tube re-taping (number of episodes per patient-days of intubation)
3. Total or partial lung collapse (number of episodes per patient-days of intubation)

4. Incidence of air leak (e.g., pneumothorax, pulmonary interstitial emphysema)
5. Incidence of subglottic stenosis or post-extubation stridor
6. Incidence of perioral or facial pressure areas and skin trauma
7. Incidence of chronic lung disease (oxygen requirement at 28 postnatal days or oxygen requirement at 36 weeks postmenstrual age)
8. Duration of hospital stay (days)
9. Duration of ventilation (days and/or hours)
10. Duration of oxygen therapy (days and/or hours)
11. Incidence of adverse neurodevelopmental outcome (e.g., cerebral palsy, sensorineural hearing loss, visual impairment and/or developmental delay) whenever measured in the primary studies
12. Incidence of long-term dentition problems (at 2, 5, 11 and 21 years of age)
13. Any other clinically relevant outcomes identified in individual studies

## Search methods for identification of studies

### Electronic searches

See: Cochrane Neonatal Review Group search strategy  
 The standard search strategy for the Cochrane Neonatal Review Group will be used. We plan to search MEDLINE from 1950 to present, CINAHL from 1982 to present, Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library) using the following strategy:  
 MeSH search terms “Infant, Newborn” OR the textwords “neonat\$” or “infant\$”  
 AND  
 MeSH search terms “Intubation, intratracheal” OR the textwords (“tracheal” OR “endotracheal” OR “endo-tracheal” OR “intratracheal” OR “intra-tracheal” OR “nasoendotracheal” OR “naso-endotracheal”) AND (“tube” OR “intubat\$”)  
 AND  
 The textwords “fix\$” or “tap\$” or “secur\$” or “stabili\$”

### Searching other resources

Previous reviews (including cross references) will also be searched. Searches will not be restricted to publications in the English language or published data.

## Data collection and analysis

### Selection of studies

Criteria and methods to assess the methodological quality of the trials: standard methods of the Cochrane Neonatal Review Group will be used.

### Assessment of risk of bias in included studies

Studies will be assessed using the following key criteria: allocation concealment (blinding of randomisation), blinding of intervention, completeness of follow-up and blinding of outcome measurement assigning a rating of 'Yes', 'No' or 'Can't tell' for each. The authors will extract data independently.

### Measures of treatment effect

For continuous variables, weighted mean differences and 95% confidence intervals will be reported. For categorical outcomes, the relative risks and 95% confidence intervals will be reported. For significant findings, the risk difference and number needed to treat and 95% confidence intervals will be reported. For outcomes such as counts or rates (such as the number of episodes of accidental extubation per patient-days of intubation) the data will be pooled as for continuous variables.

### Dealing with missing data

Where relevant we will attempt to contact the authors of the studies for additional information or data.

### Assessment of heterogeneity

The fixed effects model will be used for meta-analysis. If there are sufficient included studies, heterogeneity will be assessed using the  $I^2$  test.

### Subgroup analysis and investigation of heterogeneity

If statistical heterogeneity is found, the authors plan to look for an explanation.

### Sensitivity analysis

Data permitting, a sensitivity analysis is planned to see if results differ by quality of included studies: i.e., adequacy of randomisation (quasi-randomised versus randomised).

## REFERENCES

### Additional references

#### Ahluwalia 2005

Ahluwalia J, Brain J, Kelsail A. Procedures and Iatrogenic Disorders. In: Rennie J editor(s). *Roberton's Textbook of Neonatology*. Fourth. Philadelphia, USA: Churchill Livingstone, 2005.

#### Andrews 2007

Andrews D, DeBoer S, Adams K. Securing paediatric endotracheal tubes: Tape it like you mean it!. *Australasian Emergency Nursing Journal* 2007;**10**:30–3.

#### Angelos 1989

Angelos GM, Smith DR, Jorgenson R, Sweeney EA. Oral complications associated with neonatal oral tracheal intubation: a critical review. *Pediatric Dentistry* 1989;**11**(2): 133–40.

#### Bloch 1973

Bloch EC. Prolonged paediatric nasotracheal tube fixation. *British Journal of Anaesthesia* 1973;**45**(9):995.

#### Cussel 1974

Cussel G, Levy L, Thompson RE. A method of securing orotracheal tubes in neonatal respiratory care. *Pediatrics* 1974;**53**(2):266–7.

#### DeJonge 1998

DeJonge M, H. White M. A comparison of two methods of oral endotracheal stabilization in neonatal patients. *Journal of Perinatology* 1998;**18**(6 Pt 1):463–5.

#### Emami 1981

Emami CL, DelBianco LM. An improved technique for securing nasoendotracheal tubes. *MCN; American Journal of Maternal Child Nursing* 1981;**6**(5):337–40.

#### Grammatikopoulos 2003

Grammatikopoulos T, Devane S, Hannam S, Greenough A. Method of endotracheal tube fixation and iatrogenic ear deformities. *European Journal of Paediatrics* 2003;**162**:41–3.

#### Loughead 2008

Loughead JL, Brennan RA, DeJuilio P, Camposeo P, Wengert J, Cooke D. Reducing accidental extubation in neonates. *The Joint Commission Journal on Quality and Patient Safety* 2008;**34**(3):164–70.

#### Macey-Dare 1999

Macey-Dare LV, Moles DR, Evans RD, Nixon F. Long-term effect of neonatal endotracheal intubation on palatal form and symmetry in 8-11 year old children. *European Journal of Orthodontics* 1999;**21**(6):703–10.

#### Petros 1997

Petros AJ. A new disposable system for tracheal tube fixation in children. *Anaesthesia* 1997;**52**(4):382–3.

#### Shann 2003

Shann FA, Duncan AW, Brandstater B. Prolonged per-laryngeal endotracheal Intubation in children: 40 years on. *Anaesthetic Intensive Care* 2003;**31**:664–6.

#### Veldman 2006

Veldman A, Trautschold T, Weiss K, Fischer D, Bauer K. Characteristics and outcome of unplanned extubation in ventilated preterm and term newborns on a neonatal intensive care unit. *Paediatric Anaesthesia* 2006;**16**:968–73.

\* Indicates the major publication for the study

## HISTORY

Protocol first published: Issue 2, 2009

## CONTRIBUTIONS OF AUTHORS

Preparation of protocol - GDTI and MML

Revision of protocol - GDTI, MWD, KH and LAJ

## DECLARATIONS OF INTEREST

None

## SOURCES OF SUPPORT

### Internal sources

- Grantley Stable Neonatal Unit, Royal Brisbane and Women's Hospital, Brisbane, Australia.
- Department of Paediatrics and Child Health, University of Queensland, Brisbane, Australia.

### External sources

- No sources of support supplied